JACOB A. STOCKFISCH AND THE SOCIAL DISCOUNT RATE REVISITED

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Monterey, California

THESIS

JACOB A. STOCKFISCH AND THE SOCIAL DISCOUNT RATE REVISITED

by

Larry Joe Stamper

December 1977

Thesis Advisor: LCDR J. D. Buttinger

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Jacob A. Stockfisch and the Social Discount Rate Revisited

by

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Captain, United States Marine Corps Reserve
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Submitted in partial fulfillment of the
requirements for the degree of

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from the
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December 1977

ABSTRACT

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I. INTRODUCTION

When faced with an array of prospective investment projects of varying duration and with irregular benefit streams also of varying duration, the decision-maker employs a technique which places all projects on equal footing. Discounting is the device which enables him to evaluate the entire array of projects by a common aggregation level; discounting recognizes the time value of money and adjusts future streams, whether revenues or expenditures, to present values.

The discount rate used in private enterprise is generally accepted as the weighted average-cost-of-capital. The appropriate discount rate to be used in evaluating government investment projects has been the cause of considerable discussion and controversy. However, the wide divergence of opinions and theories does not detract from the importance of selecting a social discount rate. Baumol may have expressed it best.

> At stake in the choice of an acceptable discount rate is no less than the allocation of resources between the private and public sectors of the economy. The discount rate, by indicating what government projects should be undertaken, can determine the proportion of the economy's activity that is operated by governmental agencies, and hence the proportion that remains in the hands of private enterprise. With so much at issue it is well worth the effort to explore in some detail the principles that should be employed in arriving at a discount figure and the rationale that underlies those prin-

ciples. [1]

This paper will examine and attempt to update the work done by Jacob A. Stockfisch and published in 1969. He developed a weighted average of the before-tax corporate rate of return combined with the rate of return in the noncorporate sector. After adjusting for inflation with the use of the Personal Consumption Expenditure Index, the rate developed was 10.4%. His study was chosen for several reasons: many leading economists have agreed that 10% closely approximates the government's cost of capital; although the origin of the discount rate employed by the Department of Defense is not clear, that rate is also 10%; Stockfisch's work can be reasonably documented and updated; and since many people apparently place considerable value upon Stockfisch's developed rate, it is important to see if the rate holds true today.

Whether one agrees upon the method of developing a social discount rate or not, most all would agree with Baumol's assessment.

> Economists understand thoroughly just what this variable should measure: the opportunity cost of postponement of receipt of any benefit yielded by a public investment. They agree also on the components that should be considered in making up this figure: primarily the welfare foregone by not having these benefits available for immediate consumption or reinvestment and (perhaps) a premium corresponding to the risk incurred in undertaking government projects. Above all, economists are quite generally in accord on the view that a very serious misallocation of resources can result from the use of an incorrect estimate of the value of this variable in a cost-benefit calculation. [2]

II. PROBLEMS, QUESTIONS AND EXPECTATIONS

Stockfisch's data evaluated the period 1949-1965, but how valid are those results today? Since 1965 our economic and social fabric have come under terrific pressures: there has been increasing scrutiny of business by the public, pressuring business to place social responsibility on a par with profits; environmental controls have been instituted, and the costs incurred to satisfy these regulations have not been small; the Arab oil embargo threatened the national energy supply and resulted in the quadrupling of the price of imported oil; the country experienced double-digit inflation and double-digit cost of capital; one of the country's largest railroads went bankrupt.

When Stockfisch measured his data, he apparently did not attempt to ensure the data were measured during complete business cycles, i.e., the years from 1949-1965 saw four complete business cycles and three-fourths of another according to the information published by the government. Would different results be obtained by measuring data only for complete business cycles, or at least trying to fit the data to business cycles?

The events above would lead one to expect that profit margins may have been reduced during the years subsequent to the end of 1965, especially in the 1970's.

Further, one would expect businesses to be more profitable during the upswings of business cycles and less profitable on the downturns. Since Stockfisch does not appear to have taken this into consideration, fitting the data and business cycles more closely together may offset some of the expected profitability squeeze. To examine this more closely, Stockfisch's data and the updated data will be measured as closely as possible against business cycles.

In addition, because of the past several years' substantial increase in the rate of inflation, returns on investment must be higher in order to maintain the inflation adjusted rate of return developed by Stockfisch. All these areas will be addressed.

III. METHOD

To ensure the updated data were accumulated in the same manner as Stockfisch's, it was necessary to go to Stockfisch's original work and duplicate his procedures and his results. This was accomplished without serious difficulty. One problem frequently encountered was the government's tendency to revise published figures at some later date. This occurred on several occasions but did not have a significant impact on the final results because of the magnitude of the numbers involved.

Having duplicated the old data, the newer data were examined. Again, the information was accumulated without serious difficulty, but not without some problems. In all instances, every attempt was made to use the government's final revised numbers. Further, in one series of information, the government changed its statistical methods of acquiring information as the foundation for its publications. Undoubtedly, this has resulted in greater accuracy, but it is unlikely that significant differences would occur in the results, again due largely to the magnitude of the numbers. Additionally, in some series the government publications presented the information in slightly different format, eliminating altogether some of the categories of information that Stockfisch had used,

and consolidating that information with another set under a new category heading. Where this has occurred, a notation has been made and accompanies the data.

IV. MEASURING THE RATE OF RETURN

Stockfisch used an "earning assets" approach to computing the rate of return for the industries examined. "Earning assets" consisted of accounts receivable, inventory, plant and equipment less accumulated depreciation, and land; excluded were cash, and equity and debt claims. Earnings were usually net operating profits before interest, plus federal income taxes. Additional information on derivation of assets and earnings is contained in the Appendix.

It appears that Stockfisch computed the rates of return for the period 1949-1965 but used only 1961-1965 as the base for derivation of the discount rate. As mentioned previously, use of these time periods seems to have ignored any effect business cycles may have had upon returns. Table I depicts business cycles from 1948-1975, a span which will cover both Stockfisch's data and the newer data, as reported by Business Conditions Digest.

The evidence in Table I suggests one could approximate a complete business cycle for Stockfisch's data by using the returns from 1958-1960. Table II depicts Stockfisch's original 1961-1965 returns and the results obtained using 1958-1960 data. Table I also suggests the newer data could be measured against business cycles by taking the period 1971-1974; in the event it

Table I. Business Cycles

Peak	Trough	Peak
Nov 1948	Oct 1949	Jul 1953
Jul 1953	May 1954	Aug 1957
Aug 1957	Apr 1958	Apr 1960
Apr 1960	Feb 1961	Dec 1969
Dec 1969	Nov 1970	Nov 1973
Nov 1973	Mar 1975	

might be desirable to use two cycles to smooth the results, the period 1961-1974 could also be used. Table II includes results using both these periods. However, in order to have a "pure" comparison with Stockfisch's original results which were based upon 1961-1965, the results obtained using 1971-1975 data are also displayed.

Under Stockfisch's 1961-1965 data the rate of return for manufacturing is 15.4%; the average rate of return for the remaining sectors is 10.3%. He rounded these rates of return to 15% and 10% respectively. The rates of return for the periods displayed in Table II have been converted using Stockfisch's technique, and the results are shown in Table III. Obviously, these results are not far from the figures Stockfisch obtained with his original data.

The second part of Stockfisch's derivation procedure was based upon allocation of business investment spending. Table IV depicts the breakdown by percentage of each sector's investments for the periods indicated. Figures for 1961-1965 are Stockfisch's.

Table II. Summary of Rates of Return[1]

Sector	Annual Average Rate of Return for: 1961-1965	1958-1960	1971-1975	1971-1974	1961-1974
Manufacturing	15.4	14.5	15.7	15.7	15.4
Electric Utilities	9.3	8.9	7.1	7.0	8.3
Gas Pipelines	8.6	8.2	10.8	10.4	8.7
Telephone	11.9	12.1	7.9	8.1	10.3
Railroads	4.1	4.6	2.2	2.7	3.2
Motor Carriers	14.7[2]	10.8	19.9	20.8	16.2
Oil Pipelines	15.6	11.7	11.5	11.9	13.4
Airlines	8.2	----[3]	3.5	4.3	5.4

1. Rates of return by year is provided in Appendix Tables A-I through A-VIII.

2. Average of 1961-1964.

3. Data for 1958 was not available.

Table III. Computed Average Rates of Return

Sector	1961-1965	1958-1960	1971-1975	1971-1974	1961-1974
Manufacturing	15.4	14.5	15.7	15.7	15.4
Other	10.3	9.4[4]	9.0	9.3	9.4

4. Excluding Airline returns.

Table IV. Allocation of Business Investment Spending on Plant and Equipment[1]

Sector	Percentage of each sector in relation to all industries for the period: 1961-1965	1971-1975	1971-1974	1961-1974
Manufacturing	41	39.1	38.1	40.3
Mining	3	2.9	2.8	2.6
Commercial	24	20.7	21.4	22.2
Public Utilities	14	18.5	18.7	16.2
Communications	10	12.6	13.0	11.4
Railroads	3	2.1	2.1	2.4
Transportation, other than railroads[2]	5	4.1	4.0	4.9

1. See Appendix for total data.
2. For Stockfisch's series, data were listed under this heading title. Under the newer series, data are listed under "Other" with a separate heading for "Airlines." These two lines were summed to obtain the investment spending percentages subsequent to 1965.

Stockfisch hypothesized that the rate of return in the manufacturing sector would also apply to the mining and commercial sectors on the grounds that competition within the unregulated sector would tend to promote equality in the rates of return. Accordingly, he weighted the manufacturing rate of return of 15% at 70% (the approximate portion the unregulated sector accounted for in investment spending, i.e., Manufacturing, Mining and Commercial from Table IV) and the 10% at 30%. Thus he estimated the overall rate of return in the corporate sector, before property taxes, at 13.5%. The results obtained by appropriate weighting of Tables III and IV are shown in Table V below. Once again the figures are remarkably close to those originally developed by Stockfisch.

Table V. Weighted Rates of Return

Period	Rate of Return
1971-1975	13.2
1971-1974	13.3
1961-1974	13.3

From here, Stockfisch computed an estimate of the effective property tax rate at 1.5%. This was based upon Goldsmith's wealth estimates [3] and the Census of Governments data on taxable property values. These data were available as of 1956. More current data is not available. Therefore, adding the property tax rate of 1.5% to the 13.5% he derived earlier, he concluded the pretax rate of return in the corporate sec-

tor was 15%. Then, again using Goldsmith's data, he estimated the noncorporate rate of return to be 10%. Stockfisch further estimated that the corporate sector accounted for 40% of asset holdings while the noncorporate sector accounted for 60%. Thus the 15% and 10% returns were weighted at 40% and 60% respectively to derive an overall estimate of 12% as the rate of return, before corporate and property taxes, for investment in the entire private sector.

The data are not available to update the estimates of property tax and asset holdings between sectors. However, Tables II through V indicate the data is not significantly sensitive to change in asset holdings and the property tax, if estimated, would have a proportional effect. Since the results obtained in Table V are quite close to Stockfisch's original results, his 12% seems a quite reasonable estimate for the newer data as well. In other words, it appears that his results may have considerable validity even today, with or without considering business cycles. The only step remaining is to adjust this 12% for inflation.

V. ADJUSTING FOR INFLATION

The final step in arriving at our social discount rate is to adjust for inflation. Stockfisch did this by using the Personal Consumption Expenditure Deflator.[4] He felt this was more reasonable than using the Gross National Product (GNP) Deflator. In his opinion the GNP Deflator was composed primarily of indexes of input prices and had a strong inflationary bias. He did not discuss the rationale for preferring the Personal Consumption Expenditure Deflator over the Consumer Price or Wholesale Price indexes.

Stockfisch computed the average annual increase in the Personal Consumption Expenditure Deflator for the period 1949-1965 as 1.6%. Subtracting this from his earlier 12% gave an adjusted government cost of capital as 10.4%. However, this is where the similarity between Stockfisch's data and the current data end. The average annual increase in the Personal Consumption Expenditure Deflator and its effect on the computed cost of capital to the government is exhibited in Table VI.

As the table clearly shows, the current inflation adjusted cost of capital figures can have a substantial difference from the results obtained by Stockfisch. The 9.2% rate is close to his results, but that is the only rate within "striking" distance of his 10.4%.

Table VI. Inflation Adjusted Cost of Capital

Period	Average Annual Percentage Increase in Personal Consumption Expenditure Deflator	Inflation Adjusted Cost of Capital (with 12% base)
1949-1965	1.6	10.4
1961-1974	2.8	9.2
1971-1974	6.5	5.5
1971-1975	6.9	5.1

No matter which deflator one chooses to use, it raises several questions. By using more recent deflators, it means the cost of government capital is relatively cheap. That means more and more projects would be authorized since the return threshold is so much lower. Conversely, when capital was more expensive (in less inflationary times), fewer government projects would be undertaken because of the requirement for increased rate of return. Government spending is frequently blamed as the cause, or at least as part of the cause, of inflation; however, the above hypotheses imply more government spending during more inflationary times. On the other hand, high inflation rates also frequently accompany periods of economic recession, times when government spending may be the only relative stimulus to keep the economy going.

Principal criticism of Stockfisch's methods is that they are based primarily upon accounting data which may distort his computed rates of return. In addition,

accounting data include plant and equipment less depreciation, which may or may not be an accurate estimate of net worth. Even so, criticism is common place in economic theory, but the pursuit of an appropriate government discount rate should not be forsaken because of criticism.

In 1968, Elmer Staats, Comptroller General of the United States, conducted a review of governmental agencies.[5] He found that some were using discounting in evaluating projects while others were not. Of those using discounting, rates employed ranged from 3% to 12%. Obviously, some agencies were receiving very little benefit from the project investments while others were receiving substantially more. This kind of capriciousness can not be in the government's or the populace's best interests, and it appears one centrally computed discount rate would ensure that various governmental agencies would be demanding the same returns on investments. This also implies a more judicious distribution of funds. Stockfisch's data is almost entirely from government resources, so it should create few difficulties for the government to use his or some similar technique in arriving at a standard discount rate.

VI. CONCLUSION

The use of 10% as the cost of capital enjoys widespread use in government today, and, coincidentally or not, this figure very closely approximates the cost of capital to government obtained by Jacob A. Stockfisch. This paper endeavored to replicate the work published in 1969 by Stockfisch and, by employing his methodology, to see if his results fairly represented current rates of return and inflationary trends.

Stockfisch's estimate of an unadjusted for inflation 12% rate of return for the private sector appears to retain substantial validity today in spite of the economic traumas and upheavals experienced subsequent to its development. Derivation of this return also appears to be insensitive to business cycles. Although the data indicate it may not be necessary to compute the rates of return coincident with complete business cycles, Stockfisch's rates of return and the rates of return on the newer data can not be approximated by sampling only one or two years; Stockfisch's rates of return were derived by using data from 1961-1965, a period of five years.

The factor which significantly alters Stockfisch's findings comes about when attempting to adjust the 12% return for inflation. In that event, the adjusted discount rate varies considerably depending upon which

period is used to compute the inflation average and, of course, also which method of inflation measurement is employed.

Even with these difficulties, it is apparent that government can not ignore the discounting tool in evaluating government investment projects. Unfortunately, the lack of a standard discount rate leaves many government agencies such arbitrary latitude that uneven standards of return are used between various agencies. This imbalance in the evaluation process will be easily corrected by adoption of a standard discount rate, but, until that time, governmental evaluation techniques will be sorely lacking.

Further research on the cost of capital to government is needed, and several other areas merit closer examination. One such area is the method of adjusting for inflation. Results obtained by using the Consumer or Wholesale Price Indexes may differ significantly from Stockfisch's or this paper's results. Also, earnings and assets may be adjusted to constant dollars prior to computation of rates of return. Another area would be to alter the asset earnings base to include new items and/or delete some used by Stockfisch. As mentioned previously, these areas and many others are worthy of further research.

APPENDIX

Tabular data for 1965 and earlier and the "Derivation of Earning Asset Estimates" below are reprinted from Stockfisch's report.

A. DERIVATION OF EARNING ASSET ESTIMATES

1. Annual versus Quarterly Asset Values

For all sectors, except manufacturing, asset values were end of year (December 31) magnitudes. For manufacturing, the average of end of quarter magnitudes was employed. To the extent that an industry is growing, this difference will tend to cause the asset base to be larger when the end of year value is used than when the average of the quarters is employed, with an opposite effect on the rate of return calculation. Thus the rates of return developed in this study on the regulated industries will be slightly understated relative to those shown for manufacturing.

2. Elements of the Asset Base

a. Manufacturing - The items in the Quarterly Financial Report (FTC-SEC) "Total Receivables," "Inventories" and "Total Property, Plant, and Equipment (net)," were summed.

b. Electric Utilities - The accounts labeled "net total utility plant," "notes and accounts receiv-

able less accumulated provisions for uncollected accounts" and "materials and supplies" were summed.

c. Natural Gas Pipelines - "Net gas utility plant," "gas stored underground - non-current" accounts were summed to derive long-term assets; "notes and accounts receivable, less accumulated provision for uncollected accounts," "materials and supplies" and "gas stored underground - current" constituted short term earning assets.

d. Telephone Communications - "Total communications plant - net," "materials and supplies" and "accounts receivable from customers, agents and others" were summed.

e. Railroads - "Total properties less recorded depreciation and amortization," "materials and supplies," "net balance receivable from agents and conductors," "miscellaneous accounts receivable," and "accrued accounts receivable" were summed.

f. Oil Pipelines - Only selected balance sheet data are provided in ICC reports treating this industry. Earning assets were estimated as follows: "carrier property" less the sum of "accrued depreciation - property" and "accrued amortization - property" constituted estimate of physical plant. "Total current assets" less "cash" served as an estimate of receivables and inventory or supplies. This method undoubtedly overestimates "earning assets" as defined in this study, and will cause a slight underestimate of the

rate of return.

g. Motor Carriers - "Net carrier operating property" plus 50 percent of "current assets - total" were summed. The 50 percent factor was derived from an examination of more detailed statistics for a sub-sample of the industry.

h. Airlines - "Net value of operating equipment," "materials," "net value of spare parts" and "accounts receivable" were summed. For the years 1959 and 1960, the above short term asset accounts could not be clearly identified; hence, 50 percent of total short term assets was employed.

B. EARNINGS

1. For each of the regulated industries, annual operating income (before fixed charges, particularly interest) and major tax components (including federal income taxes) were readily identifiable. For airlines, federal subsidies (which mainly accrue to selected local route carriers) were subtracted from aggregate industry profits to derive before tax earnings. (In 1965, for example, the federal subsidy was $79 million.) It is possible that mail revenues may contain a subsidy element; however, we had no way of estimating this for a fact.

2. Manufacturing - The FTC-SEC definition of "Net profit from operations" excludes interest charges. That is, cost and expenses include interest on debt

and bonds. Thus the "profit" figure (which compares with what corporate stockholders normally focus on) would understate asset earnings by the amount of interest payments. (The FTC-SEC reports, incidentally, follow the pattern employed in the Department of Commerce national income accounting methodology). Nor do the FTC-SEC Quarterly Reports provide a separate interest cost eomponent. It was therefore necessary to estimate interest charges. (This estimate is shown by year in Table A-I.)

The estimating method for interest was as follows: The FTC-SEC reports do provide balance sheet data on "short term loans from banks," (maturity of one year or less), "installments, due in one year or less, on long term debt," and "long term debt due in more than one year." For each year the quarterly average of these items was determined; the short term item and the sum of the two long term items were multiplied by an appropriate interest rate. The sum of these products constitutes the estimated "interest" item shown in Table A-I.

The derivation of the interest rates was as follows: For long-term debt, a 10-year moving average of Moody's composite yield on industrial bonds. For short-term debt the arithmetic mean, for each year, of the rate on short-term bank loans and the rate on four to six month prime paper. These rates are shown in Appendix Table A-IX.

Table A-I

Manufacturing Earning Assets, Earnings and Rate of Return (Before Federal Income Taxes)[1]
(Earnings and Assets in Millions of Dollars)

Year	Earning Assets	Operating Profit	Interest[2]	Earnings[3]	Rate of Return
1949	79,723	14,319	344	14,663	18.4
1950	84,061	22,651	340	22,992	27.4
1951	102,045	25,365	442	25,807	25.3
1952	122,780	22,456	624	23,080	18.8
1953	129,616	24,004	702	24,706	19.1
1954	132,092	20,541	663	21,204	16.1
1955	139,144	27,655	703	28,358	20.4
1956	159,043	28,742	932	29,674	18.7
1957	170,701	27,379	1,111	28,490	16.7
1958	175,341	21,926	1,173	23,099	13.2
1959	185,819	28,699	1,350	30,049	16.2
1960	198,713	26,486	1,538	28,024	14.1
1961	208,518	26,454	1,624	28,078	13.5
1962	222,624	30,819	1,822	32,641	14.7
1963	233,604	33,777	1,887	35,664	15.3
1964	248,896	38,416	2,143	40,559	16.3
1965	274,574	45,630	2,545	48,175	17.5

Table A-I continued

Year	Earning Assets	Operating Profit	Interest	Earnings	Rate of Return
1966	312,992	51,279	3,388	54,667	17.5
1967	346,203	47,708	4,137	51,845	15.0
1968	379,062	55,538	5,090	60,628	16.0
1969	420,933	58,439	6,719	65,158	15.5
1970	457,252	49,531	8,092	57,623	12.6
1971	476,587	55,301	8,301	63,602	13.3
1972	507,806	66,452	8,955	75,407	14.8
1973	541,152	81,027	11,072	92,099	17.0
1974	548,650	83,515	12,865[4]	96,380	17.6
1975	578,654	77,103	13,516	90,619	15.7

1. Source: Quarterly Financial Report for Manufacturing Corporations, Federal Trade Commission - Securities Exchange Commission
2. Estimated by method discussed in Appendix, paragraph B.
3. Sum of "operating profit" and estimated "interest" costs.
4. A new format was used beginning this year in the source listed under footnote 1; the format listed short term debts as "bank," "commercial," and "other." These three items were summed to arrive at a single short term figure for use in estimating interest costs.

Table A-II

Rate of Return, Total and Selected Assets,
Privately Owned Electric Utilities in the U. S.[1]
(Assets and Earnings in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1949	16,475	1,323	8.0
1950	18,150	1,519	8.4
1951	19,887	1,724	8.7
1952	21,954	1,985	9.0
1953	24,517	2,183	8.9
1954	26,716	2,371	8.9
1955	28,776	2,681	9.3
1956	31,127	2,888	9.3
1957	34,136	3,012	8.8
1958	37,012	3,212	8.7
1959	39,710	3,567	9.0
1960	42,241	3,828	9.1
1961	44,401	4,058	9.1
1962	46,403	4,372	9.4
1963	48,539	4,585	9.4
1964	50,770	4,753	9.4
1965	53,534	4,995	9.3
1966	57,310	5,292	9.2

Table A-II continued

Year	Earning Assets	Earnings	Rate of Return
1967	62,277	5,518	8.9
1968	67,871	5,895	8.7
1969	74,734	6,230	8.3
1970	83,564	6,292	7.5
1971	93,575	6,718	7.2
1972	105,343	7,491	7.1
1973	118,335	8,341	7.0
1974	134,215	8,763	6.5
1975	147,070	11,099	7.5

1. Source: Statistics of Electric Utilities in the United States, Privately Owned, Federal Power Commission.

Table A-III

Natural Gas Pipeline Company Earning Assets, Earnings (Before Federal Income Taxes) and Rate of Return[1]
(Assets and Earnings in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1955	5,232	323	9.2
1956	5,789	359	9.0
1957	6,697	395	8.0
1958	7,270	427	8.0
1959	7,990	474	7.9
1960	8.718	549	8.6
1961	8.876	560	9.0
1962	9,356	605	8.6
1963	9,522	616	8.9
1964	9,397	586	8.3
1965	9,673	603	8.2
1966	10,371	795	7.7
1967	11,068	816	7.4
1968	12,248	859	7.0
1969	12,963	941	7.3
1970	13,440	1,111	8.3
1971	13,774	1,337	9.7

Table A-III continued

Year	Earning Assets	Earnings	Rate of Return
1972	14,272	1,481	10.4
1973	17,566	1,759	10.0
1974	17,853	2,038	11.4
1975	18,405	2,293	12.5

1. Source: Statistics for Interstate Natural Gas Pipeline Companies, Federal Power Commission.

Table A-IV

Telephone Communications Earning Assets, Income and Rate of Return (Before Federal Income Taxes)[1]

(Assets and Earnings in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1949	7,635	453	5.9
1950	8,239	709	8.6
1951	8,938	817	9.1
1952	9,801	915	9.3
1953	10,789	1,052	9.8
1954	11,729	1,184	10.0
1955	12,933	1,424	11.0
1956	14,685	1,572	10.7
1957	16,590	1,725	10.4
1958	18,015	2,085	11.6
1959	19,455	2,404	12.4
1960	21,108	2,601	12.3
1961	22,966	2,800	12.2
1962	24,861	3,030	12.2
1963	26,796	3,273	12.2
1964	28,964	3,377	11.7
1965	31,429	3,602	11.5

Table A-IV continued

Year	Earning Assets	Earnings	Rate of Return
1966	34,176	3,936	11.5
1967	36,865	4,173	11.3
1968	40,024	4,533	11.3
1969	44,055	4,803	10.9
1970	49,327	4,657	9.4
1971	54,711	4,625	8.5
1972	61,040	5,002	8.2
1973	67,898	5,245	7.7
1974	74,816	5,891	7.9
1975	81,014	5,830	7.2

1. Source: Statistics of Communications Common Carriers, Federal Power Commission (annual reports).

Table A-V

Railroad Earning Assets, Earnings, and Rate of Return (Before Federal Income Taxes)[1]
(Assets and Earnings in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1956	23,756	1,713	7.2
1957	24,034	1,515	6.3
1958	24,479	1,304	5.3
1959	24,469	1,340	5.4
1960	24,613	787	3.2
1961	24,496	1,167	4.7
1962	24,538	885	3.6
1963	24,593	970	3.9
1964	24,240	956	3.9
1965	25,203	1,126	4.5
1966	26,431	1,232	4.7
1967	27,070	743	2.7
1968	26,843	744	2.8
1969	27,541	761	2.8
1970	27,956	574	2.1
1971	27,873	711	2.6
1972	27,785	794	2.9

Table A-V continued

Year	Earning Assets	Earnings	Rate of Return
1973	28,437	828	2.9
1974	29,630	731	2.5
1975	30,589	79	0.3

1. Source: Transport Statistics in the United States (Annual Reports), Part 1, Railroads, Bureau of Accounts, Interstate Commerce Commission

Table A-VI

Oil Pipe Lines, Earning Assets, Income, and Rate of Return (Before Federal Income Taxes)[1]
(Assets and Earnings in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1956	1,990	328	16.5
1957	2,048	291	14.2
1958	2,094	246	11.7
1959	2,253	259	11.5
1960	2,267	269	11.9
1961	2,316	326	14.1
1962	2,316	342	14.8
1963	2,718	358	13.2
1964	2,739	476	17.4
1965	2,793	521	18.7
1966	3,051	412	13.5
1967	3,190	435	13.6
1968	3,517 (3,507)[2]	431	12.3 (12.3)[2]
1969	3,726 (3,705)	466	12.5 (12.6)
1970	4,005 (3,985)	521	13.0 (13.1)
1971	4,389	543	12.4
1972	4,758	564	11.9

Table A-VI continued

Year	Earning Assets	Earnings	Rate of Return
1973	4,950	611	12.3
1974	6,062	655	10.8
1975	8,569	847	9.9

1. Source: Transport Statistics in the United States (Annual Reports) Part 6, Oil Pipe Lines, Bureau of Accounts, Interstate Commerce Commission.
2. The reporting of assets format was changed in 1971; cash was no longer listed separately. From 1961-1970 cash averaged 19.8% of Total Current Assets. Therefore, in 1971 and subsequent years, Earning Assets were computed by deducting 19.8% of Total Current Assets in lieu of cash. The bracketed figures for 1968-1970 depict results obtained using this "cash percentage" method.

Table A-VII

Intercity Motor Carrier Earning Assets, Earnings, and Rate of Return (Before Federal Income Taxes)[1]

(Assets and Earnings in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1958	844	95	11.2
1959	966	141	14.5
1960	991	66	6.7
1961	1,020	142	13.9
1962	1,104	164	14.9
1963	1,188	166	13.9
1964[2]	1,293	208	16.1
1965	1,516	266	17.5
1966	1,700	279	16.4
1967	1,737	194	11.2
1968	1,907	303	15.9
1969	2,245	291	13.0
1970	2,315	248	10.7
1971	2,467	570	23.1
1972	2,683	594	22.1
1973	3,051	582	19.1
1974	3,276	618	18.9

Table A-VII continued

Year	Earning Assets	Earnings	Rate of Return
1975	3,383	555	16.4

1. Source: Transport Statistics in the United States (Annual Reports) Part 7, Motor Carriers, Bureau of Accounts, Interstate Commerce Commission.
2. Stockfisch's data ended with year 1964.

Table A-VIII

Airlines (Certificated Air Route Carriers) Earning Assets, Earnings, and Rate of Return (Before Federal Income Taxes and Subsidies)[1] (Earnings and Assets in Millions of Dollars)

Year	Earning Assets	Earnings	Rate of Return
1959	2,114	75	3.5
1960	2,663	22	0.8
1961	3,072	-58	---
1962	3,249	107	3.2
1963	3,236	197	6.0
1964	3,804	388	10.1
1965	4,384	593	13.5
1966	5,618	706	12.6
1967	7,145	647	9.1
1968	8.777	455	5.2
1969	9,631	351	3.6
1970	10,598	-6	---
1971	10,442	268	2.6
1972	11,104	519	4.7
1973	11,854	516	4.3
1974[2]	12,324	657	5.3

Table A-VIII continued

Year	Earning Assets	Earnings	Rate of Return
1975	12,492	60	0.5

1. Source: Civil Aeronautics Board, Air Carrier Financial Statistics, (So-called "Yellow Book," issued quarterly), Civil Aeronautics Board.
2. Actual subsidy data were not available to adjust earnings for 1974 and 1975. Therefore, data was used from Subsidy for United States Certificated Air Carriers, May, 1977, Civil Aeronautics Board, third annual supplement to the report of the same title issued March, 1974. This report lists subsidies by fiscal year. Subsidies for 1974 and 1975 were determined by taking half of each fiscal year occurring within the calendar year and summing the two halves. E.g., in 1965 Stockfisch deducted a subsidy of $79 million; this method derived a subsidy of $77 million for the same period.

Table A-IX

Interest Rates Employed to Estimate Interest Component of Manufacturing Asset Earnings[1]

Year	Short Term Rates			Moody's Composite Yield on Industrial Bonds (10-year moving average)
	Short Term Bank Loans	Prime Commercial Paper 4-6 mos.	Average	
1949	2.68	1.49	2.08	2.82
1950	2.69	1.45	2.07	2.78
1951	3.11	2.16	2.63	2.77
1952	3.49	2.33	2.91	2.77
1953	3.69	2.52	3.10	2.82
1954	3.61	1.58	2.59	2.85
1955	3.70	2.18	2.94	2.90
1956	4.20	3.31	3.75	2.99
1957	4.62	3.81	4.21	3.13
1958	4.34	2.46	3.40	3.25
1959	5.00[2]	3.97	4.48	3.42
1960	5.16	3.85	4.50	3.62
1961	4.97	2.97	3.97	3.78
1962	5.00	3.26	4.13	3.93
1963	5.01	3.55	4.28	4.04
1964	4.99	3.97	4.48	4.18
1965	5.06	4.38	4.72	4.33

Table A-IX continued

Year	Short Term Rates			Moody's Composite Yield on Industrial Bonds (10-year moving average)
	Short Term Bank Loans	Prime Commercial Paper 4-6 mos.	Average	
1966	6.00	5.55	5.78	4.51
1967	5.99	5.11	5.55	4.67
1968	6.68	5.90	6.29	4.91
1969	8.21	7.83	8.02	5.18
1970	8.48	7.71	8.10	5.55
1971	6.32	5.11	5.72	5.85
1972	5.82	4.66	5.24	6.14
1973	8.30	8.29	8.30	6.46
1974	11.28	9.84	10.56	6.89
1975	8.65	6.32	7.49	7.35

1. Source: For Stockfisch data, short-term rates from Economic Report of the President, January, 1967; long-term rate from Moody's Industrial Manual. For data subsequent to 1965, short-term rates from Survey of Current Business, Bureau of Economic Analysis, U. S. Department of Commerce; long-term rates from Moody's Industrial Manual. The figures published in Survey of Current Business for the period of Stockfisch's work are identical to those he references in the Economic Report of the President.
2. Beginning 1959, series revised to exclude loans to nonbank financial institutions.

Table A-X

Allocation of Business Investment Spending on Plant and Equipment (Billions of Dollars)[1]

	1961	1962	1963	1964	1965	1966
All Industries	34.37	37.31	39.22	44.90	51.96	63.51
Manufacturing	13.68	14.68	15.69	18.58	22.45	28.20
Mining	.98	1.08	1.04	1.19	1.30	1.62
Commercial and Other	8.46	9.52	10.03	10.83	11.79	14.48
Public Utilities	5.25	5.48	5.65	6.22	6.94	7.43
Communications	3.22	3.63	3.79	4.30	4.94	6.02
Railroads	.67	.85	1.10	1.40	1.73	2.37
Transportation, other than Railroads	1.85	2.07	1.92	2.38	2.81	3.38

	1967	1968	1969	1970	1971	1972
All Industries	65.47	67.76	75.56	79.71	81.21	88.44
Manufacturing	28.51	28.37	31.68	31.95	29.99	31.35
Mining	1.65	1.63	1.86	1.89	2.16	2.42
Commercial and Other	14.59	15.14	16.05	16.59	18.05	20.07
Public Utilities	8.74	10.20	11.61	13.14	15.30	17.00
Communications	6.34	6.83	8.30	10.10	10.77	11.89
Railroads	1.86	1.45	1.86	1.78	1.67	1.80
Transportation, other than Railroads	3.77	4.15	4.19	4.26	3.26	3.92

Table A-X continued

	1973	1974	1975
All Industries	99.74	112.40	112.78
Manufacturing	38.01	46.01	47.95
Mining	2.74	3.18	3.79
Commercial and Other	21.40	22.05	20.60
Public Utilities	18.71	20.55	20.14
Communications	12.85	13.96	12.74
Railroads	1.96	2.54	2.55
Transportation, other than Railroads	4.07	4.12	5.02

1. Source: Survey of Current Business, Bureau of Economic Analysis, U. S. Department of Commerce.

REFERENCES

[1] William Baumol, "On the Discount Rate for Public Projects," in The Analysis and Evaluation of Public Expenditures: The PPB System, U. S. Congress, Joint Economic Committee, Vol. 1, Government Printing Office, Washington, D. C., 1969, p. 201.

[2] William Baumol, "On the Social Rate of Discount," American Economic Review, Vol. 58, September 1968, p. 788.

[3] Raymond W. Goldsmith, Robert E. Lipsey and Morris Mendelson, Studies in the Balance Sheet of the United States, Princeton University Press, Princeton, New Jersey, 1963.

[4] Survey of Current Business, Bureau of Economic Analysis, U. S. Department of Commerce.

[5] Elmer B. Staats, remarks before subcommittee on Economy in Government, Joint Economic Committee, 90th Cong., 2nd Sess., 1968.

BIBLIOGRAPHY

Stockfisch, Jacob A., Measuring the Opportunity Cost of Government Investment, Research Paper P-490, Institute for Defense Analyses, March, 1969

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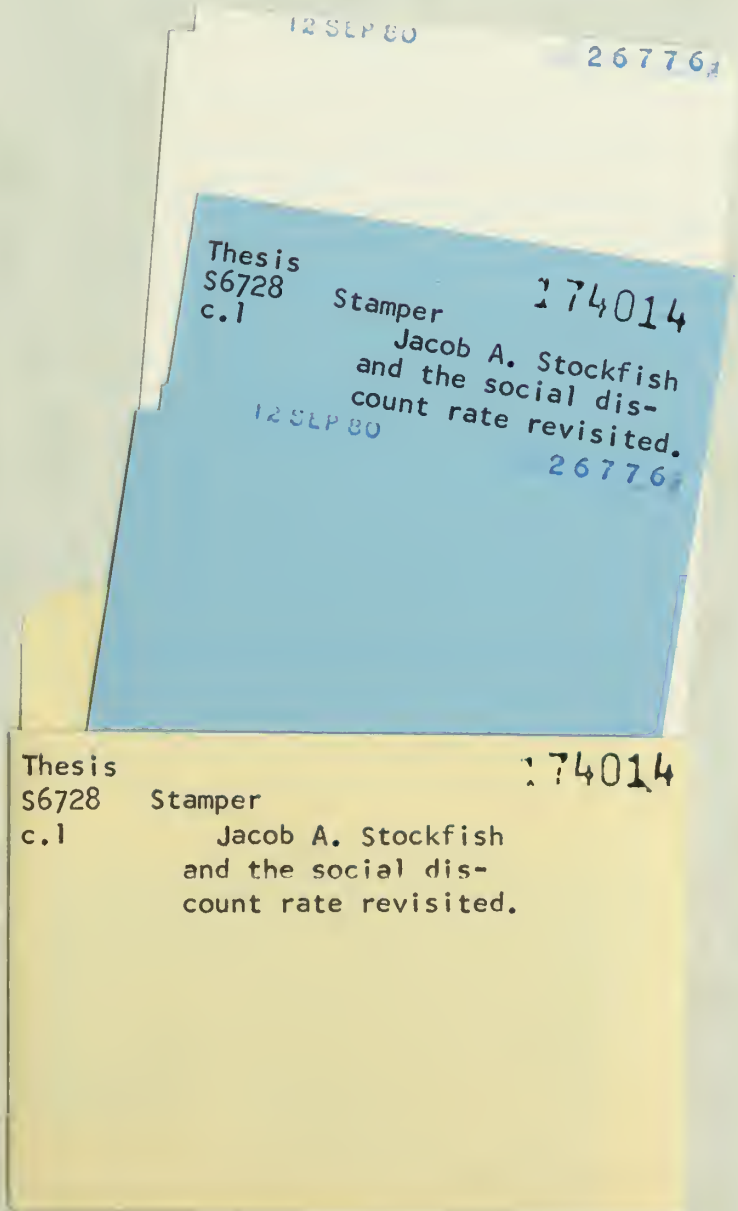
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